

GOVT 40 COMPETING VEGETATION STUDY

PALS# 60740

PROPOSAL

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A successful reforestation requires both good seedling stock and competing vegetation control following an effective site preparation in the Mediterranean climate of California (Stewart 2020; Zhang et al. 2013; 2021). Millions of acres wildfire burned forests on industries lands have been successfully reforested across California during last several decades, providing the basis from which many reforestation techniques have been developed and refined. These advances have been incorporated into the updated California reforestation practice manual (Stewart 2020), based on the previous version of the manual that was basically based on knowledge accumulated by foresters in the Forest Service (Schubert and Adams 1971). Ironically, for the last decade or so, fewer acres of successful reforestation may be found on public lands because (1) public agencies have only performed reforestation on a very small proportion of burned lands and (2) these new plantations have rarely been unsuccessful, usually consisting of unstocked trees struggling under a vigorous shrub canopy (Figure 1A).

Figure 1. Two 6-year-old plantations at the same area with competing vegetation was removed



(A) from circles of 5 feet for the largest 50% of the planted seedlings once and (B) completely by herbicide for 2 or 3 times.

The main reason for reforestation failures on public lands, compared to industrial reforestation programs, is ineffective vegetation control. Herbicide application has been demonstrated to be the most viable tool for controlling competing vegetation (Figure 1B). Other competition control methods are not only labor intensive and costly, but also less effective. Potential interactions among planting density, configuration, and vegetation control may pose new challenges for managers designing reforestation projects. From the multi-site Garden of Eden study and LTSP (Long-Term Soil Productivity) study we found that plantations could be successfully established (close their canopies to fully restock sites) within 8-15 years, without competition control across California, except for a couple of very poor-quality sites (Powers and Ferrell 1996; Zhang et al. 2017). These studies used the contemporary narrower, uniform spacing so that trees could have occupied site relatively quickly and evenly. Recent ideas for replanting on public lands could inadvertently lower near-term reforestation success by focusing on ecological goals too far in the future. One ‘working hypothesis’ has been recommended and tested for more than ten years without success is to plant seedlings by mimicking century-old stand structure (cluster configuration) because it is regarded to be more resistant to wildfire. Yet information is lacking on the near-term effectiveness of cluster planting, as this technique has not been rigorously compared to established reforestation practices. Cluster configurations would be expected to foster high competition intensity within clusters and aggressive shrub development among clusters. Without effective competition control, there is a strong chance that cluster planting configurations would neither reach reforestation goals nor create resilient forests for future.



Figure 2. Proposed study site with previously 100+ year old mixed coniferous forests.

Here, we propose establishing a test to gain key information on the effectiveness of cluster planting vs established practices under vegetation control. More importantly, this study will demonstrate successful reforestation on lands where the North Complex Fire completely killed forest near Feather Falls, California. We choose this site because it is a publicly owned, 40-ac tract with a 100+ year old mixed conifer forest prior to the North Complex Fire and is surrounded by productive industrial forest owned by SPI (Figure 2). The overstory of this 40-ac natural forest included large and small ponderosa pine, sugar pine, Douglas-fir, white fir, incense cedar, California black oak, tan oak, and Pacific madrone. Fire-killed trees have yet to be salvaged. In comparison, pre-fire PSI forests were ponderosa pine plantations where all burned trees have been salvaged and reforestation began in the spring of 2021.

Objectives:

1. To compare plantation establishment success between different planting configurations, where success is defined as achieving at least 80% planted tree survival and growth rates necessary to grow over competing shrubs and projecting being so at age five.
2. To determine whether reforestation will be less successful under current lower planting densities lower if competing vegetation is not controlled.
3. To determine whether stand growth and development vary between among planting configurations, assuming that herbicide application will yield comparable early reforestation success.
4. To create a long-term platform for comparing how effectively planting configurations achieve objectives, such as structurally heterogeneous wildlife habitat.
5. To assess whether different planting configurations and vegetation control interact to alter fire hazard for the projected future.
6. To provide an infrastructure for future silvicultural prescriptions that manipulate stand structure to create a resilient forest.

Study design:

- It will be a split-plot randomized complete block design with a combination of planting density (2 levels) and planting configuration (2 regimes) as the main plot factor and vegetation control (with and without) as the split-plot factor (Figure 3).
- Treatment factorials: $2 \times 2 = 4$
 - 2 density levels – 160 TPA and 300 TPA
 - 2 planting configurations:
 - Regular ~16' x 16' and ~12' x 12' spacing
 - Cluster planting 3 trees as a group – there will be 80 groups to match the 160 TPA density and 100 groups to match the 300 TPA density
 - Space between trees and between groups will be decided later
 - Competing vegetation control will be split from a main plot size of one acre

- Half of each acre will receive herbicide application for the first three years after planting
- Natural vegetation will be freely developed in the other half of each acre

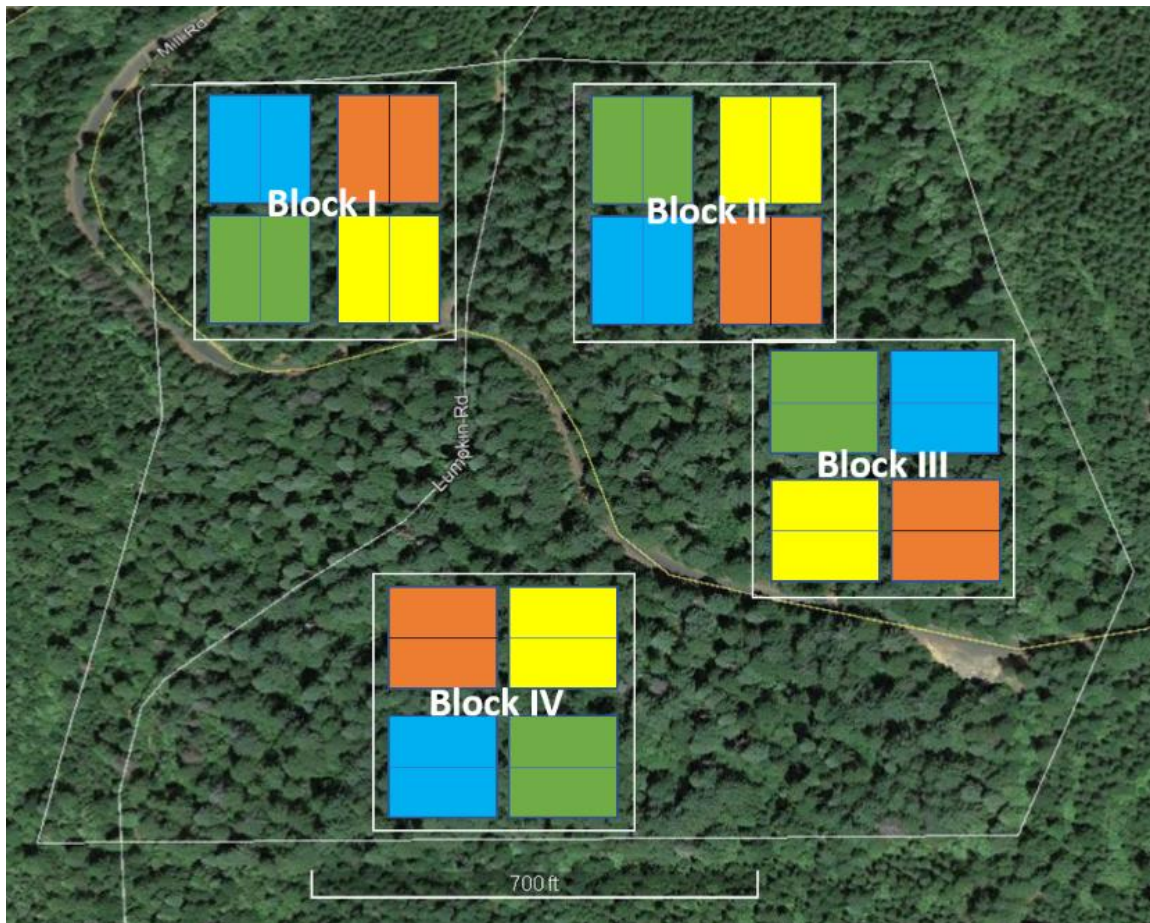


Figure 3. A hypothetical Plot layout for the study. The colors represent the treatment combination of density and planting configuration. Plot size is not based on the proportional scale.

- These combinations of treatments will be randomly assigned into each of four blocks. As soon as entire land is surveyed, we will design the field layout because the 40 acres are not uniform.
- Tree species: we propose to plant 3 or 4 species in varying proportions – ponderosa pine (50%), Douglas-fir (20%), incense cedar (15%), and sugar pine (15%). We will try to obtain seedlings from local seed sources or genetically improved seeds if they are available. If the project is funded from a grant, we may consider ordering these seedlings from Cal Forest Nurseries. In spring of 2021, SPI planted three species (PIPO, PSME, and CADE) on their land next to this ground.

- Herbicide application: For the competing vegetation-controlled subplots, we will use the registered chemicals with recommended rates on the label to apply by the licensed applicators at right time. After the NEPA is approved, we hope to contract the herbicide application to a private contractor used by forest industries. Since SPI will conduct reforestation on their burned ground for next 5 years, we may just use their crew. Because industry foresters have more experiences on herbicide application and successful plantation establishment, we will consult with them on these plantings.
- Each block will occupy about 6 acres with 4 one-ac plots and other two acres as buffers. The buffer will mimic the plot treatment to reduce the influences of the unplanted burn area on measurement plots. Total area will be 24 acres and FRRD will plant and treat other 16 acres.

Deliverables:

Results will be published in refereed journals such as Forest Ecology and Management and Journal of Forestry. Furthermore, we will share results with others as data are collected by providing field tours to foresters or presenting results in the various conferences within both science and policy-making arenas, such as the National Silvicultural Workshop and Society of American Foresters conferences.

References:

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Additional Information The proposed action is initially thought to fall within the Categorical Exclusion (CE) authorized and described in 16 USC 6554(d), Section 404 HFRA: applied silvicultural assessments.

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